Name: ______________________________ Date: ______________

Polynomial Operations SOLUTION (version 113)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = -2x^5 - x^3 + 6x^2 - 4x - 5$$

$$q(x) = 4x^5 + 2x^4 - 10x^2 - x + 8$$

Express the sum of $p(x) + q(x)$ in standard form.

Get "unsimplified" forms. Then find $p(x) + q(x)$ with addition/subtraction.

$$\begin{aligned} p(x) &= (-2)x^5 + (0)x^4 + (-1)x^3 + (6)x^2 + (-4)x^1 + (-5)x^0 \\ q(x) &= (4)x^5 + (2)x^4 + (0)x^3 + (-10)x^2 + (-1)x^1 + (8)x^0 \\ p(x) + q(x) &= (2)x^5 + (2)x^4 + (-1)x^3 + (-4)x^2 + (-5)x^1 + (3)x^0 \\ p(x) + q(x) &= 2x^5 + 2x^4 - x^3 - 4x^2 - 5x + 3 \end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = 6x^2 + 8x + 3$$

$$b(x) = 3x - 4$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$6x^2$	$8x$	3
$3x$	$18x^3$	$24x^2$	$9x$
-4	$-24x^2$	$-32x$	-12

$$a(x) \cdot b(x) = 18x^3 + 24x^2 - 24x^2 + 9x - 32x - 12$$

Combine like terms.

$$a(x) \cdot b(x) = 18x^3 - 23x - 12$$

3. Express $(x + 1)^5$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^5 + 5x^4 + 10x^3 + 10x^2 + 5x + 1$$

Polynomial Operations SOLUTION (version 113)

4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= 3x^3 + 9x^2 - 29x + 8 \\ g(x) &= x + 5 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x+5}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

$$\begin{array}{r|rrrr} & 3 & 9 & -29 & 8 \\ -5 & & -15 & 30 & -5 \\ \hline & 3 & -6 & 1 & 3 \end{array}$$

So,

$$\frac{f(x)}{g(x)} = 3x^2 - 6x + 1 + \frac{3}{x+5}$$

In other words, $h(x) = 3x^2 - 6x + 1$ and the remainder is $R = 3$.

5. Let polynomial $f(x)$ still be defined as $f(x) = 3x^3 + 9x^2 - 29x + 8$. Evaluate $f(-5)$.

You could do this the hard way.

$$\begin{aligned} f(-5) &= (3)\cdot(-5)^3 \ + \ (9)\cdot(-5)^2 \ + \ (-29)\cdot(-5) \ + \ (8) \\ &= (3)\cdot(-125) \ + \ (9)\cdot(25) \ + \ (-29)\cdot(-5) \ + \ (8) \\ &= (-375) \ + \ (225) \ + \ (145) \ + \ (8) \\ &= 3 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(-5)$ equals the remainder when $f(x)$ is divided by $x + 5$. Thus, $f(-5) = 3$.